

POWER WHEEL FOR SELF PROPELLED APPLIANCE

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The present invention relates to home appliances. More particularly, the present invention relates to a self-propelled or power assist drive system for use in an upright cleaning device. One such device can be a carpet extractor. It is to be appreciated, however, that the present invention may find further application in other environments where it is advantageous to controllably propel or assist cleaning devices, such as upright vacuum cleaners, and the like.

DISCUSSION OF THE ART

[0002] Self-propelled upright vacuum cleaners are well known in the art. However, self-propelled carpet extractors are less well known. The preferred motion of a carpet extractor or wet extractor is of a different nature than the preferred motion of an upright vacuum cleaner and thus requires a specific solution for a power-assist drive system for the extractor that solves the moisture problems as well as the mode of operation associated with the nature of the wet extractor. Specifically, the operation of an upright vacuum cleaner is characterized by quick, short strokes compared to that of an extractor. The motion of an upright vacuum cleaner is further characterized by continuously variable acceleration and deceleration. In contrast, an extractor ideally operates at a continuous velocity optimized for extraction efficiency.

[0003] The similarities shared between the two cleaning devices may lead one to conclude that a drive system designed for an upright vacuum cleaner is suitable for use in a wet extractor. This, however, will lead to operational problems if the vacuum cleaner drive is not adapted to address the distinct nature of the motion of a wet extractor. Specifically, the most popular drive systems used in upright vacuum cleaners today are mechanical friction clutches of some form. These clutches generally rely on some form of actuation force that is

imposed mechanically, usually via a mechanical linkage from a reciprocating handle to a lever that forces the friction surfaces together, coupling a drive power source to an output such as a wheel. The amount of torque transmitted between the drive power source and the output is proportional to the actuation force imposed at the friction interface. The actuation force is directly proportional to a load imposed on the handle by a user.

[0004] The load on the handle is at its highest when the acceleration of the cleaner is at its highest which is at the end of each stroke, at the instant of direction change. After a direction change, the acceleration of the cleaner typically drops to zero around mid-stroke and then increases in the opposite direction until the end of the stroke. This means that the drive provides an appropriate amount of assistance, as it is needed. This also means that the drive is most effective when the unit is either always accelerating or always decelerating since acceleration or deceleration induces a load on the reciprocating handle which, in turn, imposes an actuation force at the friction interface. In contrast, the user of a wet extractor typically desires to operate the unit at a slower, more controlled, preferably constant pace to uniformly apply and then extract as much cleaning solution as possible.

[0005] If a friction drive mechanism such as that just described is employed for a wet extractor application, the drive provides assistance upon the change of direction, but when the user tries to obtain a controlled constant linear velocity, the imposed force at the handle goes to approximately zero (constant velocity means zero acceleration) and power assist is lost. When power assist is lost, the user must impose more force on the handle to push the cleaner forward. This causes the clutch to engage and power assist is restored, but as the user continues to attempt control of the pace of the unit, power assist is again lost and a cycle of jerky motion and/or very minimal power assist ensues. In order to address this problem, a wet extractor drive should preferably operate the extractor independently of the magnitude of the actuation force and yet still provide good power assist and response to user attempts to change the direction of motion.

[0006] The present invention contemplates a drive mechanism that reduces the amount of effort (force) required by the user to propel a wet extractor forward and back. The present invention addresses issues that arise from attempting to drive an appliance on a wet surface such as loss of traction and the interaction of the drive unit with the cleaning solution. The contemplated drive system accomplishes this task in a manner that does not compromise the nature of the motion associated with a wet extractor. Specifically, the motion of a wet

extractor is characterized by relatively slow, approximately constant velocity forward and rearward linear strokes of relatively long length (compared to the typically shorter strokes of an upright vacuum cleaner).

[0007] Furthermore, the present invention contemplates a drive mechanism that provides more force to operate than an upright vacuum cleaner drive to overcome resistance caused by a high suction at the nozzle, base construction (specifically the base length), and, in many cases, a lack of forward support wheels. The present invention also provides benefit by operating the cleaner at an appropriate speed for effective wet extraction, helping to reduce operator-induced inefficiencies.

[0008] Still further, the present invention contemplates a drive mechanism that overcomes challenges associated with the operation of the extractor on a wet surface such as a loss of traction and an interaction of the drive unit with cleaning solution which can include the infiltration of the solution into the drive unit and a chemical interaction of the solution with materials of the drive unit.

SUMMARY OF THE INVENTION

[0009] In accordance with one aspect of the present invention, an upright cleaning device is provided, comprising an upper assembly to which an actuator for receiving a user input is mounted, a base assembly to which the upper assembly is pivotally mounted, a rear wheel mounted to the base assembly, configured to support the rear portion of the base assembly, and a drive mechanism located in the base assembly. The drive mechanism has its major diameter in contact with a surface to be cleaned, and the drive mechanism is configured to operate at one of: full speed in one direction, no speed and full speed in the opposite direction, according to the relative position of the actuator.

[0010] In accordance with another aspect of the present invention, a self-propelled upright cleaning device is provided, comprising a nozzle base, an upper housing section pivotally mounted to the nozzle base, a handle actuator, a wheel for supporting the nozzle base, and a drive mechanism located in the nozzle base and having its major diameter in contact with a surface to be cleaned. The handle actuator for receiving a user input is mounted on the upper housing section. The drive mechanism comprises a stationary shaft, a stationary

armature mounted on the shaft, a tubular motor housing rotatably mounted on the shaft, and a plurality of magnets mounted to an inner face of the tubular motor housing and spaced from the armature.

[0011] In accordance with yet another aspect of the present invention, a self-propelled upright cleaning device is provided, comprising a nozzle base, an upper housing section pivotally mounted to the nozzle base, a handle actuator for receiving a user input, and a drive mechanism. The handle actuator is mounted on the upper housing section. The drive mechanism is located in the nozzle base and has its major diameter in contact with the surface to be cleaned. The drive mechanism comprises a rotating motor shaft, a rotating armature mounted on the shaft, a stationary motor housing encircling at least a portion of the rotating shaft, a sun gear mounted on at least one end of the motor shaft, a planetary gear train comprising at least one planet gear engaging the sun gear, and a ring gear engaging the at least one planet gear. The ring gear is connected to a sleeve comprising a driven surface of the drive mechanism.

[0012] In accordance with still another aspect of the present invention, a method of propelling an upright cleaning device is provided, comprising the steps of sensing a user input from a handle actuator, operating a drive mechanism located in a base assembly, the drive mechanism having its major diameter in contact with a surface to be cleaned, wherein the drive mechanism is configured to operate at one of: full speed in one direction, no speed and full speed in the opposite direction, according to sensed user input.

[0013] The advantages of the present invention will be readily apparent to those skilled in the art, upon a reading of the following disclosure and a review of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The invention is described in conjunction with accompanying drawings. The drawings are for purposes of illustrating exemplary embodiments of the invention and are not to be construed as limiting the invention to such embodiments. It is understood that the invention may take form in various components and arrangement of components and in various steps and arrangement of steps beyond those provided in the drawings and associated description.

[0015] FIGURE 1 is a perspective view of a first exemplary appliance, in the form of a vacuum cleaner with a drive mechanism, in the form of a wheel, according to the present invention being exploded out from it;

[0016] FIGURE 2 is a perspective view of a bottom face of a nozzle base of the vacuum cleaner of FIGURE 1 employing the drive mechanism of the present invention;

[0017] FIGURE 3 is a perspective view from an upper side thereof of the nozzle base of FIGURE 2 with a top wall removed for clarity;

[0018] FIGURE 4 is an exploded perspective view of a drive wheel assembly according to a first embodiment of the present invention;

[0019] FIGURE 5 is an enlarged partially assembled perspective view of the drive wheel assembly of FIGURE 4;

[0020] FIGURE 6 is a fully assembled front elevational view of the drive wheel assembly of FIGURES 4 and 5 in a reversed orientation;

[0021] FIGURE 7 is a sectional view of the drive wheel assembly of FIGURE 6;

[0022] FIGURE 8A is an end elevational of the drive wheel assembly of FIGURE 6 showing heat dissipating fins;

[0023] FIGURE 8B is a greatly enlarged view of a portion of FIGURE 8A showing and motor lead openings;

[0024] FIGURE 9 is a perspective view of an armature suitable for incorporation into motors used in drive wheel assemblies according to the present invention;

[0025] FIGURE 10 is an elevation view in cutaway of a handle portion of the appliance of FIGURE 1;

[0026] FIGURE 11 is a functional block diagram of a first speed regulating mechanism suitable to control the drive wheel assembly according to the present invention;

[0027] FIGURE 12 is a functional block diagram of a second speed regulating mechanism suitable to control the drive wheel assembly according to the present invention;

[0028] FIGURE 13 is an exploded perspective view of a drive wheel assembly according to a second embodiment of the present invention

[0029] FIGURE 14A is a first sectional view of the drive wheel assembly of FIGURE 13;

[0030] FIGURE 14B is a second, reversed, sectional view of the drive wheel assembly of FIGURE 13 and,

[0031] FIGURE 15 is a perspective view of a second exemplary appliance, in the form of a carpet extractor, with a drive mechanism, in the form of a drive wheel, according to the present invention being exploded out from it.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0032] Referring to Figure 1, a self-propelled appliance **10** includes a base portion **12** and a handle portion **14**. Typically, the base portion **12** includes a means such as a drive wheel **16** (shown exploded away from the base portion **12**) for propelling the appliance **10**. Additionally, the base portion **12** may provide or house implements or actuators for performing the function of the appliance **10**. While the invention is described as being used in connection with an upright vacuum cleaner, it should be apparent that the invention could also be employed in a carpet extractor, or a similar electrically powered home appliance. However, the invention could also be used with outdoor appliances, such as lawnmowers, snowblowers, or the like.

[0033] For example, where the appliance **10** is a vacuum cleaner the handle portion can include a filter chamber **18**, and the base portion **12** may be a nozzle base. In addition to housing a means **16** for propulsion, the nozzle base includes a nozzle **20** through which dirt laden air is entrained. Dirt is removed from the air stream and collected in a bag, dirt separation chamber, or dirt cup of the filter chamber **18**. Additionally, the nozzle base may include other implements for enhancing the functionality and usability of the vacuum cleaner. For example, the nozzle base may house a brushroll **22** and additional wheels **23**, as shown in Figure 2, for improving the cleaning ability and maneuverability of the vacuum cleaner **18**. Furthermore, the nozzle base may house power supplies and control circuitry. Alternatively, power supplies and control circuitry may be located in other portions of the vacuum cleaner.

[0034] The handle portion 14 can be pivotally mounted on the base portion and provides a means for an operator to direct the operation of the appliance 10. For example, the handle portion 14 may be used to steer or direct the appliance 10. Additionally, the handle portion 14 may include control elements.

[0035] The base portion 12 is configured such that drive wheel 16 has its major diameter in contact with the ground when in an operational mode so as to exert a propelling force on the ground when signaled by an actuator 24 via input from a user. The actuator is mounted on a handle 26 extending from an upper housing section 28 of the handle portion 14. The additional wheels 23 on the nozzle base, which can be casters, allow the appliance to roll on the subjacent floor surface.

[0036] With reference now to Figure 2, the base portion comprises a housing 30 on which the one or more wheels or casters 23 as well as height positioning wheels 32 are mounted. Also provided is the drive wheel 16 which is positioned rearwardly of the brushroll 22 mounted in a brushroll chamber 36 of the home appliance and before the rear casters 23 thereof. The drive wheel can be mounted to an intermediate plate 38 with the intermediate plate, in turn, being mounted to the housing 30. The wheel 16 transmits torque to the subjacent support surface, be it carpeting or a hard surface, through a tread/ground interface thereby reducing the effort required by the operator to propel the appliance. As shown in Figure 3, the brushroll 22 can be powered by a separate brushroll motor 40, via a conventional belt (not illustrated).

[0037] With reference now to Figure 4, the drive wheel 16 can comprise a reversible drive assembly 42. The drive assembly 42 in this embodiment is best characterized as a powered wheel. The assembly is essentially a brushless DC motor distinguished from typical brushless DC motors by the fact that a shaft 44 and an armature 46 are held stationary while a set of magnets 48 and a motor housing 50 rotate around the armature 46. This allows for a fairly compact design. A traction surface 52, in the form of two tread sleeves 53, can be applied to the motor housing 50 directly and the motor, therefore, doubles as a wheel. To this end, the motor housing 50 can include a steel motor tube.

[0038] With reference now to Figure 5, motor end caps 54 can be rotatably mounted to the stationary shaft 44 by means of ball bearings 56. The bearings 56 are mounted into bearing insulators 58 which are in turn mounted into end caps 54. A rotary shaft/lip seal 60 can be

provided around the shaft 44, between the shaft 44 and the end cap 54. As shown in Figure 7, the shaft 44 can be hollowed at one end to provide a channel 62 in the shaft 44 to receive a shaft seal/strain relief 64 through which motor leads 66 are routed into the channel 62 and through a connection block/shaft seal 68 fitted in an opening 70 on the shaft surface into the internal channel 62. Further, a non-reactive material can be used for the tread sleeves 53 in order to prevent chemical interaction between the cleaning solution and the drive mechanism.

[0039] If desired, the motor end caps 54 can be constructed of aluminum and insulated on their inner surfaces all around. The end caps 54 are insulated from the bearings 56 by the insulators 58. The outer tread sleeves 53 can be made of a suitable conventional polymer and pressed on the housing 50 with adhesive enabling the motor to double as a wheel. As shown with reference to Figure 6, the tread sleeves form a joint 72 in a surface tread pattern 74. With reference to Figure 7, end caps 54 can be formed with heat dissipating fins 76.

[0040] The armature 46 further comprises coils 78 wound on laminations 80 forming the armature yoke. With reference to Figures 7 and 9, the armature 46 can include three Hall effect digital position sensors 82 (only one shown). Each Hall effect position sensor 82 is located in the center of the armature 46 axially in a wider slot opening 84 with the Hall position sensor 82 being flush with the outside diameter of the armature 46. Furthermore, the three Hall position sensors 82 can be located in three adjacent armature slots 86 with all three sensors positioned in like manner with respect to the respective armature slot 86 and armature 46. The Hall position sensors 82 can be secured in their respective slot openings 84 with high temperature epoxy. Hall leads 88 extend from each of Hall position sensors 82 out of one end of the armature 46 and below the outside diameter of the armature 46. The three leads from each of the Hall position sensors 82 provide for interconnection to the remaining Hall position sensors 82.

[0041] Figure 8A shows the depth of the traction surface 52 formed on the drive assembly 42 by the tread sleeves 53. It also shows that the heat dissipating fins 76 on the motor end caps 54 are concentric with each other and are separated by grooves 89. With reference now to Figure 8B, shaft seal/strain relief 64 is provided with Hall lead openings 90 through which Hall leads 88, of motor leads 66, exit the motor 42. The shaft seal/strain relief 64 is also provided with power lead openings 92 through which the remaining leads of motor leads 66 exit the motor 42.

[0042] With reference again to Figure 1, the handle-mounted actuator 24 provides a means for an operator to direct the movement of the appliance 10. For example, the actuator 24 may be used to grasp the appliance 10 and to steer or direct its movement. Additionally, the actuator 24 may include control elements.

[0043] For example, with reference to Figure 10, the actuator 24 may include a means 100 for determining a desired drive effort for the means of self-propulsion. For example, the means 100 for determining a desired drive effort includes a first magnet 102, a second magnet 104 and a means for sensing a magnetic field such as, for example, a Hall-effect sensor 106 and sensor leads 107. The actuator 24 also includes means 108 for changing a relative position of the magnets and Hall-effect sensor. For example, the means 108 for changing the relative position of the magnets 102,104 and Hall-effect sensor 106 can include the handle portion 26, including a handle upper half 110 and a handle lower half 112, and the actuator 24 can include a slide upper half 114 and a slide lower half 116. Such upper and lower halves 114,116 can form a tube slidably mounted to the handle 26. The handle 26 is adapted or sized and shaped to be slidably received within the actuator 24. The magnets 102,104 can be attached to magnet mounting surfaces 118 of the slide upper half 114. Fasteners, such as first and second slide screws 120,121, can be used to secure the slide upper half 114 and slide lower half 116 together. The handle upper half 110 and handle lower half 112 are similarly secured together with fasteners such as handle screws 122.

[0044] When assembled, the Hall-effect sensor 106 can be disposed between like poles of the magnets 102,104. For example, the Hall-effect sensor 106 can be situated between a north pole 124 of the first magnet 102 and a north pole 126 of the second magnet 104. This arrangement of the magnets 102,104 provides a null in a magnetic field between the magnets 102,104 and magnetic field lines of steadily increasing intensity as a relative position of a measurement point is brought closer to either of the magnets 102,104. Furthermore, due to this arrangement, lines of force emanating from the like poles 124,126 are in opposite directions.

[0045] The slide screws 120,121 also secure the slide upper half 114 and slide lower half 116 to a center section of a self-centering resilient member 128. The resilient member 128 is secured at each end to upper slide partitions 130 and lower slide partitions 132. As mentioned above, the handle 26 is adapted to be slidably received within the actuator 24.

The handle **26** constrains the actuator **24** from lateral or twisting motions. However, the handle **26** can be slid into and out of the actuator **24**, within the limits imposed by the resilient member **128**, and the partitions **130,132**.

[0046] For example, the user may direct the appliance **10** to move forward or backward by applying a pulling or a pushing force on the actuator **24**. In so doing, the user would move the handle **26** in a forward or backward direction. This urges the handle **26** into or out of the actuator **24**. As the user pushes the handle **26** into the actuator **24**, the second magnet **104** is urged closer to the Hall-effect sensor **106** and the first magnet **102** is moved further away. The Hall-effect sensor **106** senses an increased magnetic field in a first direction and produces an electric signal indicative thereof.

[0047] Similarly, if the user pulls the handle **26** out of the actuator **24**, the second magnet **104** is moved away from the Hall-effect sensor **106**, and the first magnet **102** is urged toward the Hall-effect sensor **106**. The Hall-effect sensor **106** senses first a reduction in magnetic field strength and then an increase in magnetic field strength in a second direction. The signal generated by the Hall-effect sensor **106** changes in concert with these sensed changes in the magnetic field. The user moves the handle **26** into or out of the actuator **24** according to a desired drive effort. Therefore, the signal produced is indicative of a desired drive effort.

[0048] As the user moves the handle **26** into or out of the actuator **24**, portions of the resilient member **128** are compressed while other portions are stretched by movements of the second slide screw **121**. Therefore, restorative potential energy is stored in the resilient member **128**. If the user should release the actuator **24**, the energy stored in the resilient member **128** returns the second slide screw **121** and, therefore, the handle **26** and the magnets **102,104** to the neutral position.

[0049] In the neutral position, the Hall-effect sensor **106** is located approximately equidistantly between the magnets **102,104** in a null between their respective magnetic fields. The signal from the Hall-effect sensor **106** indicates this neutral magnetic field thereby providing an indication that the desired drive effort is zero.

[0050] While the resilient member **128** in the illustrated embodiment can be made of a resilient polymer, the resilient member **128** can also be made of other known resilient materials. For example, a resilient member can be fashioned from two wound wire springs

joined together to provide a central aperture between them and the loops for receiving the second slide screw 122 and other mounting screws as necessary.

[0051] With reference now to Figure 11, electrical signals to the armature assembly 46 via motor leads 66 can be provided from a power source 140 through a speed adjusting circuit 142. Alternately, with reference to Figure 12, a sensor assembly 144, can be provided, for calculating a position of the motor housing 50 relative to the armature 46. For example, the above-described Hall sensors 82 can provide position information via Hall leads 88 of motor leads 66 to the speed adjusting circuit 142, which permits selection of the proper commutated signal to be sent along leads 66 to the armature 46. The sensor assembly 144 may, alternately, include an optical type sensor configured to detect rotations of the housing. While the speed adjusting circuit 142 is illustrated as being located outside of the wheel assembly 42, the circuitry could alternately be placed within the wheel assembly 42 if so desired.

[0052] Moreover, the speed adjusting circuit or device 142 can incorporate various functional capabilities such as constant brushroll speed maintenance; overload protection stopping brushroll rotation; reverse brushroll operation easing, for example, backward movement of the vacuum cleaner; and variable brushroll rotation depending on floor surface, e.g. no rotation on tile, wood and delicate floor coverings, and fast rotation for heavy duty carpeting or especially dirty environments.

[0053] Another embodiment of a drive wheel assembly of the present invention is depicted in Figures 13-14. In this embodiment, as shown in Figure 14A, a motor 150 comprises a brushless DC motor, however, the motor is more typical in that a shaft 152 and an armature 154 rotate while a set of magnets 156 and a motor housing 158 remain stationary. As shown in Figure 13, the shaft 152 is outfitted with a sun gear 160 on at least one end (spur or helical type, either integral with the shaft or mounted on the shaft) for input into a planetary gear train 161, including several planet gears 162, of at least one stage. Each of the planet gears 162 is mounted on a mount plate 164 connected to the motor housing 158. The planet gears 162 mesh with a ring gear 166 that is either integral with or mounted and fixed to an inner surface 167 of a sleeve 168. The sleeve 168 is rotatably mounted on bearings 170 and 172 positioned on the motor housing 158. Bearings 174 and 175 mount a pair of motor housing end plates 176 and 177 on the shaft 152. The sleeve 168 can be provided with a tread surface for engaging the surface to be cleaned.

[0054] The reduction provided by the gear train allows for a more common, higher speed, lower torque motor that provides cost and availability advantages relative to the above-described stationary shaft motors. Control and actuation methods similar to those used for the first embodiment can be employed to direct the movement of the appliance, such as a vacuum cleaner or the like.

[0055] Another appliance in which the drive mechanism of the present invention can be used is a carpet extractor. For ease of appreciation of this embodiment, like components are identified by like numerals with a primed (') suffix and new components are identified by new numerals.

[0056] With reference now to Figure 15, the appliance can be a carpet extractor, as opposed to a vacuum cleaner. As before, the position of the Hall-effect sensor with respect to the magnets determines the output voltage from the Hall-effect sensor. This output voltage is interpreted by a speed adjusting circuit and translated to an appropriate output speed and direction for the motor. For example, if the excitation voltage to the Hall-effect sensor is 5 VDC then a Hall-effect sensor that outputs 2.5 VDC when positioned exactly midway between the magnets can be used. With such a construction, ranges from 1 VDC to 4 VDC, at the extremes of travel of the actuator 24' with respect to the handle 26', would be seen. In this exemplary arrangement, 1 to 2 VDC corresponds to full speed in one direction, 2 to 3 VDC corresponds to a no speed, stationary position, and 3 to 4 VDC corresponds to full speed in the opposite direction. While one possible arrangement is disclosed, it should be appreciated that other arrangements of the Hall-effect actuation structure are also within the scope of the instant disclosure.

[0057] In an extractor application, a control algorithm can be adapted to ramp up the speed of the drive motor to avoid jerky or abrupt direction changes. This method addresses the issues associated with the slow constant velocity nature of an extractor's motion. The output speed is the same through a fairly large range of travel toward either extreme of the actuator 24' position. This yields the same output speed for varying levels of input at the actuator 24' yet still accommodates the user's desire to change direction. Thus, the constant, controlled speed desired for an extractor is attained and further optimized for efficient extraction.

[0058] With continuing reference to Figure 15, a self-propelled carpet extractor 180 includes a base portion 182 and a handle portion 14'. The base portion 182 includes the

above-described drive wheel 16' (shown removed from the base portion 182) for propelling the self-propelled carpet extractor 180. Additionally, the base portion 182 houses implements or actuators for performing the function of the carpet extractor 180.

[0059] For example, the base portion 182 may include a cleaning solution dispensing means (not shown). In addition to housing the drive wheel 16' for propulsion and a means for dispensing cleaning solution, the nozzle base portion 182 includes a nozzle 186 through which dirt laden cleaning solution is entrained. Dirt laden solution is removed from the nozzle and collected in a collection chamber, or other portion of the carpet extractor 180. Additionally, the nozzle base portion 182 may include other implements for enhancing the functionality and usability of the carpet extractor 180. For example, the nozzle base may house brushes, beater bars and additional wheels 188 for improving the cleaning ability and maneuverability of the carpet extractor 180. Furthermore, the base portion 182 may house power supplies and control circuitry. Alternatively, power supplies and control circuitry may be located in other portions of the carpet extractor 180. As described above, the handle 14' provides a means for an operator to direct the operation of the carpet extractor 180.

[0060] A change in motor direction can be accomplished via the use of an on off on rocker style switch input into the control electronics, if so desired. The switch can be actuated via the use of a reciprocating handle as illustrated in Figure 10. Design elements used in the previous embodiments to address issues such as solution infiltration into the drive assembly and solution interaction with the drive assembly and the tread can also be incorporated in the embodiment of Figure 15.

[0061] With the present invention, a reduced force is required by a user to propel the carpet extractor forward and back. Also, traction is not lost by the drive mechanism on a wet surface. In addition, the specific nature of motion of a wet extractor, characterized by relatively slow forward and rearward linear strokes, is not compromised by the drive mechanism. Rather, control and activation methods similar to those used for the embodiment shown in Figures 1-10 can be employed to regulate the movement of the carpet extractor. Moreover, operator inefficiencies are reduced by operating the carpet extractor at an appropriate speed for effective wet extraction.

[0062] The invention has been described with reference to several preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and

understanding the preceding specification. It is intended that the invention be construed as including all such modifications and alterations insofar as they fall within the scope of the appended claims and equivalents thereof.